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A Multitrait-Multimethod Matrix for Self-Perceptions: Implications for Discriminant Validity

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Nine different self scales, along with the corresponding ratings on the same traits by peers and adults, were administered to children and adolescents. With a multitrait-multimethod matrix formulation, the results indicated general differentiation on the nine scales, suggesting situation-dependent and divergent self-pictures. Interpersonal congruence was found most often between self-perceptions and peer-perceptions. Results of discriminant analysis yielded distinct separation of group centroids (grades and gender) on all factors. Further nomological research in self concept would seem to require greater emphasis on creative theory-construction.

A Multitrait-Multimethod Matrix for Self-Perceptions:

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Louise M. Soares
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Nomological research appears to have taken hold in the area of self concept (e.g., Marx & Winne, 1978). As noted, there indeed are available more studies of the between-network variety (i.e., comparing self-concept scores with some other variable, such as achievement) than within-networks (i.e., subunits of the self construct). Between-network research is at a disadvantage, however, since: (1) its premise is a general self concept underlying other areas of human activity (cf., Loevinger, 1966; Sears, 1964); and (2) within-network studies which define and clarify the construct of self concept should precede inter-variable research (Wylie, 1974).

On the other hand, within-network studies to date have not provided sufficient evidence as foundation for effective between-network research. Beyond the fact that within-network studies are more recent, the few multitrait-multimethod studies published have not seemed to distinguish among facets of a self concept. A typical study in this regard (Winne, Marx, & Taylor, 1977) discovered convergence of physical, social, and academic self concept rather than discriminant validity. Additional attempts to present a hierarchical structure of self have not thus far been convincing (Shavelson, Hubner, & Stanton, 1976)--because they focus on situation-dependent explanations, and they force the construct of self into separate components. Hence, one of the reasons for not finding discriminant evidence may very well be because the theoretical constructs are not themselves discriminating. An alternative theoretical direction has previously been proposed, extrapolating

models of intelligence to self theory (Soares & Soares, 1977).

Spearman (1927) initially developed a theory of intelligence as predominantly a generalized function. He believed that all individuals possessed this "g" factor in various degrees, as it was common to all mental activity. Spearman then postulated specific factors which would be involved in different tasks. Therefore, the g factor provided the most crucial explanation of an individual's level of intelligence, and the s factors supplied the differential dimensions of the individual's level of mental functioning. Does the self have this same generalized function?

A second approach is suggested by Thurstone's primary mental abilities (1943) in that intelligence is believed to be an expression of several highly specific factors. These factors may be relatively independent of one another, although experimentation has often revealed evidence for a basic general factor in addition to the semi-autonomous specific factors. Vernon (1950) would seem to postulate a similar position, with a hierarchical model of abilities. Is the self an expression of several highly specific factors?

The third system of thinking provides a multi-dimensional model, as espoused by Thorndike (1927). He believed that intelligence consisted of highly specific processes and that, if a high degree of relationship is indicated among any of these processes, mental functioning on the basis of common elements would be indicated. Some research seems to point toward perhaps 80 separate intellectual abilities with a possible 40 more as predicted by a comprehensive unified theory. Guilford (1959, 1968) suggests a taxonomic model, which conceptualizes a three-way classification involving operation or process, content or materials, and products by way of factor

analytic methods. Cattell (1963) has taken this multi-factor view of the intellect one step further in distinguishing crystallized and fluid intelligence, wherein the former refers to perceiving relations via culturally acquired skills versus the individuation of learning experiences in the latter.

Piaget (1952) adds still another dimension to the formulation of intelligence. The organism's schemes for understanding the world increasingly become transformations carried out mentally without physical action --i.e., "interiorized actions."

To extrapolate a set of principles which had been promulgated in one area of human knowledge to another with the expressed purpose of enlightenment, or at least explanation, is not without its dangers. However, since the mental operations involved in developing a concept of self are similar to those involved in developing configurations, cognition, evaluative abilities, divergent thinking, and the like, the bridging process may not be as tenuous as one would at first believe.

In relating this discussion on intelligence to self-perceptions research, the authors are suggesting a differentiating theoretical foundation--one that goes beyond the obvious base of a general self concept in combination with a hierarchical paradigm and one that includes a processing thrust--for building cognitive images, for engaging the environment, and for developing conceptions of reality.

Piaget typically indicates that affectivity provides an energizer in its parallel growth with cognitive development, though it "does not modify the cognitive structure" (Evans, 1973, p. 7). Furthermore, since cognitive structures are forms of organization of, and adaptation to, the perceived

environment (Piaget, 1952), it would seem logical to interact the concepts of intelligence and self.

The present study was designed to test the varying perspectives of self, as determined by distinct or discrete situations and individual perceptions, within a multitrait-multimethod framework, as designed by Campbell and Fiske (1959), and to provide evidence for the validity of the measures in the form suggested by Michael, Pless, and Lee (1973).

METHODS

Subjects

From suburban classrooms in the Northeast, 698 students in grades one through twelve were randomly selected. There were two peer-raters for every student providing self-perceptions. Teachers at every grade level rated the same students.

Instrumentation

The subjects were administered the Affective Perception Inventory (API) --an instrument which yields scores on self concept as a person and as a student, perception of self in six specific classroom disciplines (language arts, mathematics, science, social studies, the arts, physical education), and finally perceptions of self in school and toward important figures in school (Soares & Soares, 1976). Representative items for each of the nine scales are noted below:

1. Self Concept/Person:

   I am a happy person. ____:____:____:____ I am not a happy person.

2. Student Self:

   I learn quickly. ____:____:____:____ I learn slowly.

3. Self in Language Arts (English):

I am a good reader.	____:____:____:____	I am not a good reader.

4. Self in Mathematics:

I find math. easy.	____:____:____:____	I find math. hard.

5. Self in Science:

I am good at working out science problems.	____:____:____:____	I am not good at working out science problems.

6. Self in Social Studies:

I keep up with what is going on in the world.	____:____:____:____	I do not keep up with what is going on in the world.

7. Self in the Arts:

I can paint well.	____:____:____:____	I cannot paint well.

8. Self in Physical Education:

I am good in team sports.	____:____:____:____	I am not good in team sports.

9. Self in School:

I think teachers care about me.	____:____:____:____	I think teachers do not care about me.

Each of these nine scales was administered to the students, with the primary-grade children having the items read to them. There were two peer-raters for each self-rater analyzed in addition to the teacher-raters, using the same items changed to the third-person singular. Discussion here centers upon the multitrait-multimethod results and discriminant analysis.

RESULTS

The multitrait-multimethod matrix for the subscales of the API is displayed in Table 1, and the highlights are in Table 2.

Monotrait-Monomethod Correlations (M-M).

The reliability coefficients are along the outside diagonal within parentheses. These were obtained from Rulon's split-half method (1939) which utilizes the variance of the differences between the randomized scores on two test-halves for each individual and the variance of total scores:

$$r_{1I} = 1 - \frac{\sigma_d^2}{\sigma_x^2}$$

This formulation views chance error as represented in the difference between the split-halves. The variance of these differences, when divided by the total variance, takes into account the proportion of error variance. Finally, when this result is subtracted from one, the "true" variance is yielded.

In terms of the coefficients themselves, internal consistency seems operative. For the students, seven of the nine self-ratings indicated correlations of .81 or higher. None of the peer-rating coefficients was below .61; the lowest for the teacher-ratings was .65.

Monotrait-Heteromethod Correlations (M-H).

The validity coefficients are boxed and are indicated in the shorter diagonals (Table 1). In the comparison of self- and peer-ratings, the greatest agreement overall appeared on the School Perceptions (.76), and of the subject areas in particular, Mathematics Perceptions (.55); the lowest, on the Arts (.38). With self- and teacher-ratings, the highest correlations were found on Student Self (.74) and Language Arts (.50); the lowest again on the Arts (.30). When comparing the peer- with the teacher-ratings, the strongest relationship occurred on School (.80) and Language Arts (.57) and the weakest on the Arts (.26).

All M-H coefficients were larger than the median H-H correlations. When comparing the M-H coefficients with their corresponding H-H correlations arranged in a diamond design around the validity coefficients, almost all (the latter) are lower in value. For example, the coefficient of .50 for the interaction of self-ratings and peer-ratings on Scale #2 (Student Self) is higher than any of the four values surrounding it--that is, .32 (Self, Scale #2; Peers, Scale #1), .42 (Self, Scale #3; Peers, Scale #2), .45 (Self, Scale #2; Peers, Scale #3), and .33 (Self, Scale #1; Peers, Scale #2). The only exceptions are on Scale #1 for Self and Teachers (.37, which is below .50 for Self/Scale #2 and Teachers/Scale #1) and the .29 on Scale #4 (Mathematics) for Peers and Teachers, which is especially lower than the .39 for Peers/Scale #4 and Teachers/Scale #3. The higher M-H coefficients represent convergence at a moderate level in most cases. The interaction of Self and Peers was the most consistent and least dispersed of the three pairings.

Heterotrait-Monomethod Correlations (H-M).

These correlations are indicated in solid, outside triangles of Table 1. None of the self-peers M-H validity coefficients fell below the median correlations for either the self- or peer-ratings. Three of the nine self-teacher M-H coefficients were lower than the median H-M correlation for self-ratings --Scale #7 (Arts), Scale #8 (Physical Education), and Scale #9 (School). Four values of the peer-teacher interaction did fall considerably below the .38 of the peers H-M correlation--.29 (Scale #4/Math.), .28 (Scale #6/Social Studies), .26 (Scale #7/Arts), and .27 (Scale #8/Physical Education). Since Scales #7 and #8 are common in both cases, it would seem that these scales

have little discriminant validity, possibly due in part to common method variance.

There is some confounding among the scales, but discriminant validity exists in most cases. The self-peers M-H coefficient on Scale #2 is lower than the H-M correlation in only one instance--.66, Method (1) on Scales #2 and #3. The other exception for the interaction of self-peers is the .38 on Scale #7 when compared to .46 for Self/Scales #3 and #7. The H-M value on Scales #2 and #3 comes out higher again for peer-ratings (.63) when compared to the self-peers coefficient on Scale #2 (.50). There are two other isolated instances in the comparison of self-peers M-H coefficients with the H-M correlations within the peer-ratings: (a) the .62 for Scales #2 and #4; (b) the .48 for Scales #3 and #6. The most consistent confounding occurs with Scale #9. The correlations of .59, .60, .52, and .51 for the peers H-M are higher than the respective coefficients from the M-H of the self- and peer-ratings.

This situation continues with the H-M correlations for the teacher-ratings on Scale #9 with #2 and #3 as well as the clustering of Scales #1, #2, and #3--all of the values ranging from .70 to .73. As indicated, however, the discriminant validity would seem to be operative since the H-M correlations: (a) for self-ratings are moderate to low in all but one case; (b) for peer-ratings are moderate to low in most cases except for Scale #2 with Scales #3 and #4 and for Scale #9; (c) for teacher-ratings are moderate to low in most cases except with the clustering of Scales #1, #2, #3, and also again with Scale #9.

Heterotrait-Heteromethod Correlations (H-H).

Construct validity requires lower H-H correlations than M-H values.

For the most part, such is the case, as noted in the broken, inside triangles of Table 1. There is some confounding again, however, on Scale #9 with a few of the other scales. For example, in the comparison of self and peers, the M-H coefficient (.49) on Scale #3 is lower than the correlation between Self/Scale #9 and Peers/Scale #3 (.53); also, the .39 on Scale #6 for self and peers as opposed to the .42 for Self/Scale #9 and Peers/Scale #6. Other exceptions can be found in the comparison of peers and teachers: (1) Scale #1 (.35) as contrasted with the .52 at the end of that row and the .46 at the bottom of the corresponding column; (2) Scale #2 (.40) as contrasted with the .62 and .51 for the respective row and column.

When using Discriminant Analysis on the same data, the discriminant functions of the nine scales were first derived; then the analysis and classification techniques were generated, as suggested elsewhere (Cacoullos, 1973; Lachenbruch, 1975).

The initial analysis used the nine self-concept scores as discriminating variables (Table 3). Because of the eigenvalues generated and the level of significance for the Wilks' Lambda method, only the first three derived functions seemed to have importance for further discussion. Therefore, these are listed in Table 4 and subsequently labeled as "Academic Self," "School Self," and "Humanistic Self," respectively. Figure 1 illustrates the relative positions of the twelve-grade centroids (mean vectors). The percentage of grouped cases correctly classified was 72.21% (grades) and 69.85% for the gender groups.

DISCUSSION

The pattern that emerges from the results can be summarized as follows:

(1) Internal consistency on all scales.

(2) Respectable convergent validity between Self and Peers on Self Concept, Student Self, Language Arts, Mathematics, Science, and School; and between Self and Teachers on Student Self, Language Arts, Mathematics, Science, and Social Studies. There was less agreement between peers and teachers, especially noted on Language Arts and School. This result has been previously reported on (Soares & Soares, 1978), indicating a hierarchy of rater-impact ranging from parents (highest significant others), to peers, and lastly to teachers.

(3) Differential discriminant validity in that three varied pictures became salient.

(a) A frequent clustering of Self Concept, Student Self, Language Arts, and School Perceptions quite distinct from (b) below.

(b) Divergence of Mathematics and Science (and sometimes Social Studies) from each other as well as from (a) above and (c) below.

(c) A fuzziness implicit in the Arts and Physical Education scales in that low correlations existed for both convergent and discriminant validation, suggesting inconsistent and wide dispersion.

(4) Subjects demonstrating discriminating weights on:

(a) The nine horizontal dimensions, as determined by the differentiating

experiences in an academic environment.

(b) The twelve developmental levels, as noted on the vertical stages in traditional school settings.

(c) Gender

Self-perceptions would seem to be varied and multiple, providing congruent and differentiating dynamics both horizontally or interpersonally --i.e., among perceivers--and vertically or intrapersonally--i.e., within the individual. The genesis of this position suggests an interfacing of cognitive dimensions and behavioral determinants. Furthermore, the mind's capacity as an information-processing and pattern-detecting apparatus would seem to provide another source for conceptualization. Future research, therefore, requires multilevel directives:

1. A much more creative and aggressive approach to theory development.
2. A finer tuning of test construction, especially in self-report and observational methods.
3. A greater sophistication in generating analytical paradigms.
4. A potentially fruitful tapping of results from brain-functioning research.

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Table 2

Summary of Multitrait-Multimethod Coefficients

Type	Max	Min	Median
Monotrait-Monomethod			
Self	.94	.63	.84
Peers	.85	.61	.78
Teachers	.87	.65	.82
Monotrait-Heteromethod			
Self/Peers	.76	.38	.49
Self/Teachers	.74	.30	.47
Peers/Teachers	.80	.26	.35
Heterotrait-Monomethod			
Self	.66	.13	.37
Peers	.63	.22	.38
Teachers	.73	.03	.28
Heterotrait-Heteromethod			
Self/Peers	.53	.01	.21
Self/Teachers	.50	.02	.23
Peers/Teachers	.62	.01	.18

Table 3

Analysis of Discriminant Functions Derived as Differentiating School Experiences

Discriminant Function	Eigenvalue	Relative Percentage	Canonical Correlation	Functions Derived	Wilks' Lambda	Chi-Square	
				0	.4182	530,045	*
1	.44911	45.74	.557	1	.6060	304,507	*
2	.20531	20.91	.413	2	.7304	190,973	*
3	.13768	14.02	.348	3	.8310	112,544	*
4	.07990	8.14	.272	4	.8974	65,811	
5	.04191	4.27	.201	5	.9350	40,851	
6	.03667	3.73	.188	6	.9693	18,955	
7	.01582	1.61	.125	7	.9846	9,413	
8	.01105	1.13	.105	8	.9955	2,732	
9	.00450	0.46	.067				

* $p < .001$

Table 4

Standardized Discriminant Function Coefficients
(First Three Only)

Scores	Function 1	Function 2	Function 3
1	.1204	-.40624	.14985
2	.3106	-.09856	-.28022
3	-.57914	.01035	-.22873
4	-.66798	.22240	-.32604
5	.35827	.06926	.40691
6	.32150	.05216	-.52095
7	-.04176	.07924	.84414
8	-.27749	-.49061	-.17625
9	-.22474	-.48038	-.31509

Figure 1

Separation of Grade Centroids
and
Approximate Centours in Reduced Space

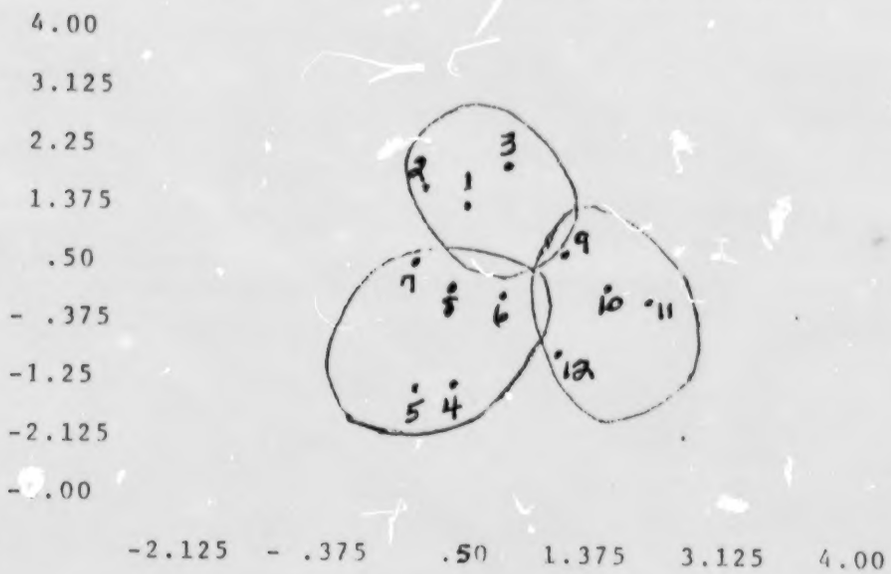

Table 1

Multitrait-Multimethod Matrix

		Method 1								
		1	2	3	4	5	6	7	8	9
Method 1										
Scale	1	(.94)								
	2	.47	(.79)							
	3	.44	.66	(.89)						
	4	.27	.38	.27	(.81)					
	5	.41	.35	.37	.37	(.88)				
	6	.38	.39	.33	.25	.33	(.88)			
	7	.25	.42	.46	.13	.33	.23	(.63)		
	8	.45	.35	.23	.24	.41	.29	.21	(.84)	
	9	.45	.41	.49	.40	.46	.38	.38	.35	(.83)
Method 2										
Scale	1	[.49]	.32	.23	.20	.30	.11	.03	.32	.38
	2	.33	[.50]	.42	.40	.38	.20	.03	.19	.48
	3	.12	.45	[.49]	.41	.27	.09	.14	.05	.53
	4	.17	.38	.29	[.55]	.31	.07	.11	.19	.52
	5	.17	.46	.30	.25	[.51]	.14	.01	.22	.33
	6	.25	.36	.43	.24	.20	[.39]	.18	.16	.42
	7	.09	.17	.15	.09	.04	.11	[.38]	.02	.26
	8	.15	.14	.22	.05	.05	.20	.09	[.44]	.19
	9	.34	.50	.42	.47	.36	.26	.26	.14	[.76]
Method 3										
Scale	1	[.37]	.50	.29	.03	.13	.21	.17	.24	.23
	2	.30	[.74]	.41	.06	.23	.20	.19	.21	.36
	3	.29	.43	[.50]	.10	.28	.30	.24	.19	.43
	4	.06	.28	.23	[.47]	.25	.09	.05	.20	.26
	5	.22	.42	.27	.23	[.47]	.17	.03	.06	.30
	6	.25	.27	.37	.22	.14	[.47]	.07	.03	.46
	7	.06	.08	.20	.10	.08	.12	[.30]	.16	.23
	8	.29	.34	.34	.16	.11	.12	.02	[.33]	.33
	9	.24	.29	.24	.04	.23	.13	.20	.35	[.34]

		Method 2								
		1	2	3	4	5	6	7	8	9
Method 1										
Scale	1	(.82)								
	2	.49	(.71)							
	3	.51	.63	(.80)						
	4	.51	.62	.42	(.85)					
	5	.27	.[illegible]	.27	.50	(.81)				
	6	.38	.52	.48	.53	.38	(.78)			
	7	.39	.36	.40	.35	.35	.34	(.61)		
	8	.27	.33	.25	.22	.32	.38	.30	(.69)	
	9	.31	.59	.60	.52	.31	.51	.26	.33	(.68)
Method 2										
Scale	1	[.35]	.36	.30	.03	.14	.15	.14	.07	.52
	2	.36	[.40]	.11	.08	.12	.25	.12	.08	.62
	3	.03	.40	[.57]	.39	.36	.13	.17	.02	.32
	4	.22	.16	.31	[.29]	.20	.18	.24	.02	.09
	5	.20	.28	.36	.13	[.38]	.26	.31	.38	.12
	6	.02	.03	.09	.05	.15	[.28]	.20	.17	.01
	7	.33	.09	.20	.11	.04	.20	[.26]	.17	.31
	8	.13	.27	.07	.26	.18	.20	.20	[.27]	.12
	9	.46	.51	.08	.21	.15	.22	.14	.11	[.80]

		Method 3								
		1	2	3	4	5	6	7	8	9
Method 1										
Scale	1	(.66)								
	2	.72	(.82)							
	3	.71	.73	(.87)						
	4	.09	.27	.31	(.86)					
	5	.14	.41	.45	.52	(.84)				
	6	.42	.46	.44	.13	.27	(.82)			
	7	.08	.04	.22	.10	.12	.20	(.66)		
	8	.28	.36	.29	.22	.14	.13	.03	(.81)	
	9	.48	.70	.70	.21	.21	.28	.11	.29	(.65)

KEY: Method 1--Self
Method 2--Peers
Method 3--Teachers

Scale 1--Self Concept
Scale 2--Student Self
Scale 3--Language Arts (English)
Scale 4--Mathematics
Scale 5--Science
Scale 6--Social Studies
Scale 7--The Arts
Scale 8--Physical Education
Scale 9--School